AP Statistics
Test: *t* Distribution for Means
Instructor's Version

Free Response: 2 questions, 52 points, 30 minutes

1. Here are the weights, in pounds, of a sample of 13 adult female golden retriever dogs: 59.0, 54.1, 53.7, 51.6, 57.5, 58.7, 58.0, 53.8, 48.9, 53.9, 51.6, 55.9, and 57.4.

A. What are the degrees of freedom, and what's the critical value of *t* needed to construct a 95% confidence interval for the population mean weight of adult golden retrievers? (4 points)

Answer:
$df = 12$, $t = 2.179$

B. Can we use *t* procedures to do inference for the mean weight of the population of adult golden retrievers? Explain, and include a sketch of a data plot. (6 points)

Answer:
Yes. Students should show some kind of plot that demonstrates that the data are not extremely skewed and does not have outliers. This can be a boxplot, dotplot, histogram, or stemplot.

C. Construct a 95% confidence interval for the mean weight of the population of adult golden retrievers. Show your work. (8 points)

Answer:

$54.93 \pm 2.179(\frac{3.12}{13}) = 54.93 \pm 2.179(.87) = (53.04, 56.82)$

Students need to show their work to get full credit. An answer alone, such as might be obtained from a calculator, should be worth, at most, 25% of the credit available for this problem.

D. Suppose someone was to do a test of the hypothesis $H_0: \mu = 52$. Interpret the confidence interval you obtained in part C of this problem as it pertains to this hypothesis. (8 points)

Answer:
The confidence interval obtained in part C does not contain the value 52. Therefore, we have evidence that the true population mean is not 52. A significance test of the hypothesis would reject the null hypothesis at the .05 level of significance.

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2. This table shows the weights of two groups of people after graduating from two different weight-control programs.

Program 1	Program 2
235	180
225	175
190	180
188	185
195	178
	182

Conduct a test of the hypothesis that Program 2 is more effective for maintaining a lower weight than Program 1. Be complete in your answer. Be sure to include all parts of the hypothesis testing procedure. (26 points)

Answers:
NOTE to instructor: All four parts of the procedure must be shown for the response to be considered complete, although they do not need to be numbered and broken out in exactly this way.

(i) $H_0: \mu_1 = \mu_2$ (The mean weights are the same.)
$H_a: \mu_1 > \mu_2$ (The mean weight from Program 1 is greater than the mean weight from Program 2.) (7 points)

(ii) Since a boxplot (or other demonstration) shows no outliers or extreme skewness, *t* procedures are justified here (students must show something – a plot of some kind – and not simply state this claim). (7 points)

(iii) $df = 4,\ t = \dfrac{206.6 - 180}{\sqrt{\dfrac{21.80^2}{5} + \dfrac{3.41^2}{6}}} = \dfrac{26.6}{9.85} = 2.70$ $.025 < P < .05$ (7 points)

$P = .026$ on the TI-83, $df = 4.16298$. Student should show something about how *t* was computed. If a calculator was used, the student should give the exact value of *P* rather than a range. Students should not pool variances since they are clearly not close enough to be judged the same – if they do, they can still get the mechanics correct, but they should be docked for using the wrong test!

Alternate response for (iii):

For a 95% confidence interval with 4 *df*, $t^* = 2.776$,

$(206.6 - 180) \pm 2.776$

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or (−.33, 53.53), *df* = 4.16298 on the TI. This approach should not receive full credit since the hypothesis is one-sided and this approach is two-sided. Note also that they would get a different conclusion with this approach.

(iv) This *P*-value is low enough to provide good evidence against our null hypothesis. Therefore, we have evidence that the mean weight of graduates from Program 1 is greater than the mean weight from graduates of Program 2.

They can still get this step completely correct if they do a confidence interval in step (iii) and have the correct conclusion that the programs do not appear to achieve different results. (5 points)

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